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THESIS

LOW-RATE INITIAL PRODUCTION (LRIP): ORIGINS, IMPLEMENTATION AND ANALYSIS

by

Mark A. Thompson

December 2000

Thesis Advisor:
Associate Thesis Advisor:

Richard B. Doyle
Frank J. Barrett

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| 13. ABSTRACT (maximum 200 words) Low-Rate Initial Production (LRIP) provides units to be used in the acquisition system for operational testing and to validate the production process. This thesis examines the evolution of LRIP to identify its primary purposes and the problems that have been encountered during its implementation. To provide this information, historical and current statutory, legislative and regulatory data were reviewed. GAO and DODIG audits and reports provided critical information relating to LRIP problems. It was found that the most important LRIP problems centered on the issue of the appropriate number of units to be produced and the timing of the migration of programs into and out of LRIP. The principal cause of these problems was the absence of clear and definitive legislative and regulatory guidance. New acquisition regulations and a new acquisition model are likely to minimize the ambiguity surrounding the use of LRIP in the acquisition process. | | | | |
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AND ANALYSIS**

Mark A. Thompson
Major, United States Marine Corps
B.A., Virginia Military Institute, 1986

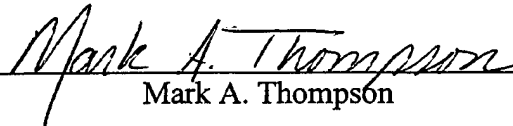
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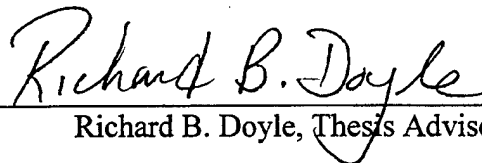
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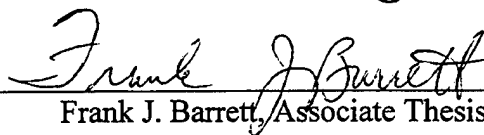
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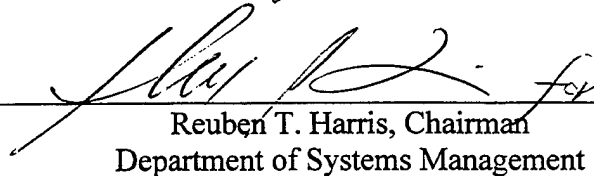
Author:


Mark A. Thompson

Approved by:


Richard B. Doyle, Thesis Advisor


Frank J. Barrett, Associate Thesis Advisor


Reuben T. Harris, Chairman
Department of Systems Management

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ABSTRACT

Low-Rate Initial Production provides units for operational testing and is also intended to prove out the production process. This thesis examines the background of LRIP to present the reason and intent for its establishment. Additionally, it analyzes the LRIP problems encountered during its evolution. To provide this information historical and current statutory, legislative and regulatory data were reviewed. Also, GAO and DODIG audits and reports provided investigative information relating to LRIP problems. The findings of the analysis determined that LRIP problems encountered in the past were due to unclear regulations and policies that failed to provide adequate guidance on the LRIP procedure and oversight requirements. However, the new acquisition regulations and model appear to eliminate the ambiguity in the process and should eliminate problems encountered during LRIP.

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TABLE OF CONTENTS

| | | |
|------|---|----|
| I. | INTRODUCTION | 1 |
| A. | PURPOSE | 1 |
| B. | BACKGROUND | 1 |
| C. | THESIS OBJECTIVES | 3 |
| D. | RESEARCH QUESTIONS | 3 |
| E. | SCOPE AND ORGANIZATION | 3 |
| | 1. Scope | 3 |
| | 2. Organization | 3 |
| F. | METHODOLOGY | 4 |
| II. | HISTORY OF LOW-RATE INITIAL PRODUCTION | 5 |
| A. | INTRODUCTION | 5 |
| B. | ACQUISITION REVIEWS | 6 |
| C. | PERTINENT INITIATIVES AND COMMISSIONS | 7 |
| D. | LEGISLATION | 9 |
| E. | EXECUTIVE ACTIONS | 10 |
| F. | REGULATORY BACKGROUND | 11 |
| G. | CURRENT REGULATIONS AND LAW | 12 |
| | 1. DoD 4245.7-M, <u>Transition from Development to Production</u> | 12 |
| | 2. DoD Directive 5000.1, <u>The Defense Acquisition System</u> | 13 |
| | 3. DoD Instruction 5000.2, <u>Operation of the Defense Acquisition System</u> | 13 |
| | 4. Interim Regulation DoD 5000.2-R, <u>Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information Systems (MAIS) Acquisition Programs</u> | 13 |
| | 5. United States Code, Title 10 | 14 |
| | a. Section 2400 – Low-Rate Initial Production of New Systems | 14 |
| | b. Section 2366 – Major Systems and Munitions Programs: Survivability Testing and Lethality Testing Required Before Full-Scale Production | 15 |
| | c. Section 2399 – Operational Test and Evaluation of Defense Acquisition Programs | 16 |
| III. | LOW-RATE INITIAL PRODUCTION IN THE ACQUISITION PROCESS | 19 |
| A. | INTRODUCTION | 19 |
| B. | THE MILESTONES AND PHASES | 19 |

| | | |
|-----|---|----|
| 1. | Technology Opportunities and User Needs | 20 |
| 2. | Concept and Technology Development | 21 |
| 3. | System Development and Demonstration..... | 23 |
| 4. | Production and Deployment | 24 |
| 5. | Operations and Support..... | 26 |
| C. | ACQUISITION CATEGORY (ACAT) | 26 |
| D. | ACQUISITION STRATEGIES | 28 |
| 1. | Prototypes | 29 |
| 2. | Concurrency | 31 |
| E. | SUMMARY | 32 |
| IV. | ANALYSIS AND CONCLUSION | 33 |
| A. | INTRODUCTION | 33 |
| B. | ANALYSIS..... | 33 |
| 1. | Quantity Issues..... | 33 |
| 2. | Readiness Issues..... | 34 |
| C. | CONCLUSION..... | 37 |
| D. | RECOMMENDATIONS FOR FURTHER RESEARCH..... | 38 |
| | LIST OF REFERENCES..... | 39 |
| | BIBLIOGRAPHY | 43 |
| | GLOSSARY | 47 |
| | INITIAL DISTRIBUTION LIST | 49 |

LIST OF FIGURES

| | | |
|-----------|--|----|
| Figure 1. | The 5000 Model..... | 19 |
| Figure 2. | Technology Opportunities and User Needs Work Content | 20 |
| Figure 3. | Concept and Technology Development Work Content | 21 |
| Figure 4. | System Development and Demonstration Work Content..... | 23 |
| Figure 5. | Production and Deployment Work Content..... | 24 |
| Figure 6. | Operations and Support Work Content..... | 26 |

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LIST OF ACRONYMS

| | |
|------------|---|
| ACAT | Acquisition Category |
| ACTD | Advanced Concept Technology Demonstration |
| AIS | Automated Information System |
| ASD (C3I) | Assistant Secretary of Defense for Command, Control, Communication and Intelligence |
| ATD | Advanced Technology Demonstration |
| CAE | Component Acquisition Executive |
| DFARS | Department of Defense Federal Acquisition Regulation Supplement |
| DoD | Department of Defense |
| DOT&E | Director, Operational Test and Evaluation |
| DT&E | Developmental Test and Evaluation |
| FAR | Federal Acquisition Regulation |
| FASA | Federal Acquisition Streamlining Act of 1994 |
| GAO | General Accounting Office |
| IOT&E | Initial Operational Test and Evaluation |
| LFT&E | Live Fire Test and Evaluation |
| LRIP | Low-Rate Initial Production |
| MAIS | Major Automated Information System |
| MDA | Milestone Decision Authority |
| MDAP | Major Defense Acquisition Program |
| MNS | Mission Needs Statement |
| OMB | Office of Management and Budget |
| ORD | Operational Requirements Document |
| OT&E | Operational Test and Evaluation |
| PM | Program Manager |
| PMO | Program Management Office |
| RDT&E | Research, Development, Test and Evaluation |
| S&T | Science and Technology |
| SecDef | Secretary of Defense |
| USD (AT&L) | Under Secretary of Defense for Acquisition, Technology and Logistics |

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I. INTRODUCTION

A. PURPOSE

The purpose of this thesis is to examine the origin and implementation of Low-Rate Initial Production (LRIP). It begins with a definition of LRIP, as well as its intended purpose. Part of this definition will include an historical review of LRIP and its place within the acquisition process. The analysis portion will review how LRIP has been implemented in the acquisition process. Additionally, the analysis portion will consider the problems that have been encountered during the application of LRIP and the problems it still may be encountering.

B. BACKGROUND

Acquisition reform, or the need for it, has been a constant feature of U.S. defense policy since the end of World War II. This fact can probably be explained by the increasing complexity of weapon systems since that time. Additionally, with the end of the Second World War and the beginning of the Cold War, more companies were joining what came to be known as the Defense Industrial Base.

The United States government was spending money to try and counter the military threat posed by the Soviet Union. This arms race was not limited to the numbers of weapons and different types of weapon systems, but included the need to be more technologically advanced than the Soviet Union. Although spending by the Department of Defense was nowhere near what it was during World War II for obvious reasons, it was still significant enough that it encouraged U.S. companies to bid for work in the defense sector.

The issue eventually became not only of quantity, but also of quality. To ensure the quality of defense acquisitions, the items needed to be tested prior to mass production. While this requirement seems obvious, it led to significant problems in the process. One answer to the problems was Low-Rate Initial Production. Low-Rate Initial Production is defined as "the minimum number of systems (other than ships and satellites) to provide production representative articles for operational test and evaluation, to establish an initial production base, and to permit an orderly increase in the production rate sufficient to lead to full-rate production upon successful completion of operational testing." (Ref. 1, pages B-71 – B-72).

The concept of Low-Rate Initial Production can be traced back to the McNamara Initiatives of 1961. However, it was not until the recommendations of the 1986 Packard Commission that it eventually became a significant part of the acquisition cycle. It was implemented to address increasing costs related to military acquisitions.

Its application and enforcement have continued to evolve. These changes are primarily related to issues involving specifications and quantities. For example, 100 percent of the AN/ALQ-135 Quick Reaction Jammer systems authorized were procured under LRIP. Only a "minimum number" are to be produced during LRIP, not the entire authorized amount.

Other issues concern the number of items to be considered "low rate," the question of whether a weapon system has been tested sufficiently to enter low rate initial production, the type of tests required under LRIP and the criteria for transitioning beyond LRIP. The C-17 suffered from known problems with its wings and flaps, but LRIP was

authorized. A weapon system is not supposed to enter into LRIP with known deficiencies. LRIP items are produced for operational testing, not immediate repair

C. THESIS OBJECTIVES

The objective of this thesis is to provide a complete picture of LRIP in the acquisition process. This thesis will have three primary areas: (1) the origins and development of LRIP, (2) the application of LRIP in the acquisition process, and (3) the problems encountered in its application

D. RESEARCH QUESTIONS

1. What is Low-Rate Initial Production?
2. Why do we have Low-Rate Initial Production?
3. What is the history of Low-Rate Initial Production?
4. How is Low-Rate Initial Production policy being implemented?
5. What major problems with Low-Rate Initial Production have emerged?

E. SCOPE AND ORGANIZATION

1. Scope

The focus of this thesis is to examine the development and implementation of Low-Rate Initial Production by the Department of Defense. It will concentrate on the purpose, current application and major policy and fiscal problems associated with Low-Rate Initial Production. Finally, this thesis will provide an insight into the transformation of the military acquisition process.

2. Organization

Chapter II is an historical presentation of Low-Rate Initial Production and the acquisition process. It focuses primarily on the studies, commissions, legislation and current regulations and directives pertaining to LRIP and the acquisition process.

Chapter III is a presentation of the milestones and phases of the acquisition process and their implications for LRIP. It also reports other acquisition strategies related to the concept of LRIP.

Chapter IV reviews the planning process and its requirements in reference to the application of LRIP. This will include the requirements necessary to transition from the development phase to the production phase.

Chapter V provides a review of the application of LRIP, past and present. The chapter also covers the problems encountered in the application of LRIP.

F. METHODOLOGY

The primary method of data collection has been through literature research. The majority of the literature comes from the library and the Internet. Some examples of the reviewed literature include executive branch directives, legislative testimony, federal laws, Department of Defense directives and regulations, as well as reports and audits conducted by the General Accounting Office and the Department of Defense Inspector General.

II. HISTORY OF LOW-RATE INITIAL PRODUCTION

A. INTRODUCTION

This chapter discusses the history of Low-Rate Initial Production and the acquisition process. It identifies the studies, commissions, legislation and regulations that pertain to the acquisition process and LRIP.

Prior to World War II, the United States would "gear up" production when it needed to respond to major military requirements. The companies normally involved in supporting the military with supplies and weapons were not sufficient during a time of war to support the increased demand. The rest of the industrial base of the United States was called upon to convert their production lines from producing cars and clothing to producing tanks and uniforms. After the event, such as World War I, was over, the industrial system reverted back to its commercial activities, the swords were beaten back into plowshares, and the troops were sent home. This all changed after World War II.

At the end of World War II the United States found itself in a new position as the world leader for democracy. On the other side was the Soviet Union, representing the threat to our way of life. We could not completely gear down our systems and go home. It was the end of our isolationism. We had to be prepared to stem the tide of communism wherever it may try to grow, especially if it threatened a current democratic regime. The structure needed to support this new role did not exist; it had to be created.

The Department of Defense, after World War II, was not set up to handle the major issues of weapons acquisition, nor was it geared up to handle the developing defense industrial base. Many of the government's post war activities, i.e., commissions and legislation, were in response to these dilemmas. However, most of the significant

actions pertaining to acquisition policy have come in the last twenty years. This is due to more public awareness of government spending, especially during the heavy deficit years of the Reagan administration. Another "major factor contributing to the sustained visibility of the defense acquisition reform movement has been an increasingly involved U.S. Congress." (Ref. 2, pg. 4)

B. ACQUISITION REVIEWS

There have been numerous reviews directed toward improving the acquisition process. The president in office at the time of the review requested most of them. The following list is not all-inclusive, nor do all of the items on it necessarily pertain to acquisition improvement only. It represents the more prominent studies of the defense acquisition problems in the U.S.

- *The Hoover Commissions* (1949 and 1955) – Commission on Organization of the Executive Branch of the Government.
- *The McNamara Initiatives* (1961).
- *Fitzhugh Commission* (1970) – President's Blue Ribbon Defense Panel.
- *Commission on Government Procurement* (1972).
- *Carlucci Initiatives* (1981) – Acquisition Improvement Task Force.
- *Grace Commission* (1983) – President's Private Sector Survey on Cost Control.
- *Packard Commission* (1986) – President's Blue Ribbon Commission on Defense Management.
- *Defense Management Review* (1989) – The Rittenhouse Report
- *Defense Science Board* (1983) – Transition for Development to Production.
- *Defense Science Board* (1986) – Functional Performance Requirements.
- *Defense Science Board* (1987) – Technology Based Management.

- *Defense Science Board* (1989) – Use of Commercial Components in Military Equipment.
- *Defense Science Board* (1991) – Acquisition Streamlining Task Force.
- *Section 800 Panel* (1993)– Department of Defense Acquisition Law Advisory Panel.

The reviews most relevant to LRIP were the McNamara Initiatives, the Commission on Government Procurement and the Packard Commission.

C. PERTINENT INITIATIVES AND COMMISSIONS

Robert McNamara served as the Secretary of Defense (SecDef) from 1961 through 1968. His initiatives

instituted many of the first substantial acquisition reforms through his centralized decision-making apparatus and the new Planning, Programming, and Budgeting System. McNamara insisted on disciplined guidelines and techniques for measuring and evaluating the requirements process and program management, including establishing formal phases or steps through which a program had to proceed from concept, through research and development, and into production – essentially the life-cycle process used today. (Ref. 3, pg. 402)

The *Commission on Government Procurement* said that “the need to improve major system acquisition has been made apparent by the succession of cost overruns, contract claims, contested awards, buy-ins, bail-outs, and defective systems that have drawn sharp criticism to one or more programs in recent years.” (Ref. 4, pg. 69)

Although the Commission did not explicitly say that LRIP was the solution to any or all of these problems, they did note that there was a need to “limit premature commitments through field demonstrations” and that weapon systems needed to be “operationally tested before full production.” (Ref 5, pg. 111)

It was the President's Blue Ribbon Commission on Defense Management of 1986, or *Packard Commission*, that championed the cause for low-rate initial production.

President Reagan established the Commission

in part because the public confidence in the effectiveness of the defense acquisition system has been shaken by a spate of 'horror stories' – overpriced spare parts, test deficiencies, and cost and schedule overruns. Unwelcome at any time, such stories are particularly unsettling when the Administration and Congress are seeking ways to deal with record budget deficits. A major task of this Commission has been to evaluate the defense acquisition system, to determine how it might be improved, and to recommend changes that can lead to the acquisition of military equipment with equal or greater performance but at lower cost and with less delay. (Ref. 6, pg. 41)

The *Packard Commission*, in their Interim Report to the President, recommended that "the first units that come off the limited-rate production lines should be subjected to intensive operational testing and the systems should not enter high-rate production until the results from these tests are evaluated." (Ref. 7, pgs. 17-18) In A Formula For Action, in addition to the aforementioned, the commission further suggested "low-rate production should continue during testing." (Ref. 8, pg. 22) Additionally, the 1989 *Defense Management Review* and the "1990 DoD Annual Report to the President and Congress supported implementation of the *Packard Commission* recommendations, including testing to identify and remedy problems well prior to commencement of high rate production." (Ref. 9, pg. 3)

The *Fitzhugh Commission* argued that there were "major benefits to be derived by producing weapons systems at a lower rate production." (Ref. 10, pg. 9) However, this recommendation was for the entire production evolution and not just the initial phase.

D. LEGISLATION

Some of the aforementioned studies and commissions led to legislation to improve the acquisition process. Again, the list is not all-inclusive, but includes the most significant acquisition reform legislation.

- *Armed Services Procurement Act* (1947).
- *Small Business Act* (1963).
- *Office of Federal Procurement Policy Act* (1983).
- *Competition in Contracting Act* (1984).
- *Department of Defense Procurement Reform Act* (1985).
- *Defense Procurement Improvement Act* (1986).
- *Defense Acquisition Improvement Act* (1986).
- *Department of Defense Reorganization (Goldwater-Nichols) Act* (1986).
- *Ethics Reform Act* (1989).
- *Defense Acquisition Workforce Improvement Act* (1990).
- *Federal Acquisition Streamlining Act (FASA)* (1994).
- *Federal Acquisition Reform Act* (1996).
- *Cohen-Clinger Act* (1996).
- Annual defense authorization legislation.

The most significant annual defense authorization bill was the National Defense Authorization Act for Fiscal Years 1990 and 1991 (P.L. 101-189), which codified LRIP. The Act defined LRIP and attempted to limit LRIP quantities. It required that "in the course of the development of a major system, the determination of what quantity of articles of that system be procured for low-rate initial production shall be made...when the decision to approve the full-scale engineering development is made." (Ref. 11) This

piece of legislation came about because of congressional concern “about the sometimes significant quantity of systems produced during LRIP and before system performance is operationally demonstrated.” (Ref. 12, pg. 2)

The *Federal Acquisition Streamlining Act* established more specific limitations on LRIP quantities. The quantity “may not be less than one operationally configured production unit and it was not to exceed 10 percent of the total number of articles to be produced.” (Ref. 13)

E. EXECUTIVE ACTIONS

Authority and guidance bearing on LRIP also comes from the Executive Branch in the form of executive orders, national security (presidential) decision directives, and other agency regulations. Examples include:

- *OMB Circular A-109* (1976).
- *Executive Order 12352* (1982).
- *Federal Acquisition Regulation (FAR)* (1984).
- *National Security Decision Directive 219* (1986).
- *Executive Order 13011* (1996).
- *OMB Circular A-11* (1997). (Ref. 14, pg. 9)

OMB Circular A-109 was the first official directive to address limited production for testing purposes. This circular established and mandated the process that would become known as LRIP. It stated that the “initial production units are to be tested and evaluated in an environment that assures effective performance in expected operational conditions.” (Ref. 15, pg. 20) It further required that before full production could commence, the initial production units had to satisfactorily pass the operational tests.

Additionally, "it established uniform phases and decision milestones for the development and production of major systems." (Ref. 3, pg. 406)

F. REGULATORY BACKGROUND

In 1947, purchasing for DoD was governed by an Armed Services Procurement Regulation approximately 125 pages long. Since then, the number of instructions has grown significantly.

One of the most significant acquisition regulations was written in the latter part of the 1950s.

The framework for program management may be attributed to the Air Force Systems Command when it published a series of regulations popularly referred to as the '375 series.' These regulations and the accompanying manuals originated in missile/space programs, where failure could not be tolerated. The 375 series went into detail on how systems acquisition should be managed from formulation of a system concept until "phase-out." (Ref. 16, pg. 4)

The number of directives, regulations and policies that pertain to defense acquisitions are in the hundreds. In fact, the quantity has drawn criticism for years. The 1972 *Commission of Government Procurement* "found a burdensome mass of procurement regulations within individual Federal agencies and little or no system to coordinate and control the regulations" (Ref. 5, pg. 7). The *Grace Commission* found that "procurement regulations are excessive and, in some cases, inconsistent." (Ref. 10, pg. III-81) The Packard Commission reiterated this point. In A Formula For Action it stated, "Over the years, Congress and DoD have tried to dictate management improvements in the form of ever more detailed and extensive laws or regulations. As a result, the legal regime for defense acquisition is today impossibly cumbersome." (Ref. 8, pg. 18)

In an effort to combat these problems, the Department of Defense has made efforts to reduce the number of acquisition regulations, either by combining similar regulations or by simply canceling some of them. Additionally, to aid in research and referencing, it created the Defense Acquisition Deskbook in 1996. For the first time all the regulations, documents, and their current changes, relevant to defense acquisitions, were available on the Internet. It also helped in paper reduction. The most current version of some regulations, such as the DoD Directive 5000.1, are only available on-line.

On 23 October 2000, the acquisition process went through a major revision with the implementation of the new DoD Directive 5000.1 and the reauthorization of the DoD Instruction 5000.2. Recommendations from General Accounting Office (GAO) reports were the principle guidance for the changes.

Below are the primary regulations that pertain to the use and implementation of LRIP.

G. CURRENT REGULATIONS AND LAW

1. DoD 4245.7-M, Transition from Development to Production

DoD 4245.7-M “provides assistance in structuring technically sound programs, assessing their risk, and identifying areas needing action.” (Ref. 17) It provides direction for developing a smooth transition plan from development to full rate production. This includes low rate initial production. The transition plan includes considering the use of the templates from the manual that describe techniques for reducing risk and improving the process.

2. DoD Directive 5000.1, The Defense Acquisition System

DoD Directive 5000.1 “provides policies and principles for all DoD acquisition programs, describes applicable management principles, and provides mandatory policies and procedures for the management of acquisition programs, except when statutory requirements override.” (Ref. 18, pg. 2) It also explicitly forbids milestone decision authorities from committing the DoD to LRIP “unless and until certain fundamental criteria have been considered and evaluated. These criteria include, but are not necessarily limited to, demonstrated technology maturity; well-defined and understood user requirements that respond to identified threats; acceptable interoperability, affordability, and supportability; and a strong plan for rapid acquisition using evolutionary approaches as the preferred strategy, open systems designs, and effective competition.” (Ref. 8, pg. 6)

3. DoD Instruction 5000.2, Operation of the Defense Acquisition System

DoD Instruction 5000.2 “establishes a simplified and flexible management framework for translating mission needs and technological opportunities, based on validated mission needs and requirements, into stable, affordable and well-managed acquisition programs that include weapon systems and automated information systems.” (Ref. 19, pg. 1) It also sets a “general approach for the management of acquisition programs and further stipulates that any particular project or program, particularly non-major programs, need not follow the entire process.” (Ref. 19, pg. 1)

4. Interim Regulation DoD 5000.2-R, Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information Systems (MAIS) Acquisition Programs

The rewrite of DoD Directive 5000.1 cancelled the DoD Regulation 5000.2-R. It was being rewritten and revised in 2000. The interim regulation will serve in its place

until the revised regulation is signed. This is expected to be done in December 2000. "This memorandum establishes a simplified and flexible management framework for translating missions needs into stable, affordable, and well-managed MDAPs and MAIS Acquisition Programs." (Ref. 20, pg. 2) It establishes the requirement for an acquisition strategy to include a test and evaluation strategy. The latter strategy is to be structured to incorporate developmental, operational and live fire testing and evaluation, as well as modeling and simulation. Completion of initial operational and live fire testing and evaluation are requirements to proceed beyond LRIP.

5. United States Code, Title 10

The following sections addressing Title 10 of the U.S. Code identify and define some of the key offices, processes and programs relevant to LRIP. Sections 133 and 139 define the positions of Under Secretary of Defense for Acquisition, Technology and Logistics (USD (AT&L)) and the Director of Operational Test and Evaluation (DOT&E) respectively.

The USD (AT&L) establishes all policies and regulations pertinent to acquisitions, including procurement and testing issues relevant to LRIP. The DOT&E is the senior DoD official for Operational Test and Evaluation (OT&E). Successful completion of OT&E is a requirement to proceed beyond LRIP.

a. Section 2400 – Low-Rate Initial Production of New Systems

Title 10 not only defines LRIP, but also stipulates what is to be considered "low rate." In Section 2400 LRIP is defined and the quantities for LRIP are established. The number of units procured for low-rate initial production is determined during Milestone B of the acquisition process, formerly known as Milestone II. The SecDef reports the number of units determined to Congress.

The number of units "procured for low-rate initial production may not be less than one operationally configured production unit unless another quantity is established at the milestone II (B) decision." (Ref. 21) The number of units to be procured for LRIP is not intended to exceed 10 percent of the total number of units to be produced. However, if it does, the SecDef must justify the higher amount in the report to Congress.

"Low-rate initial production of weapon systems, except naval vessels and satellite programs, with respect to a new system is production of the system in the minimum quantity necessary-

(1) To provide production-configured or representative articles for operational tests.

(2) To establish an initial production base for the system; and

(3) To permit an orderly increase in the production rate for the system sufficient to lead to full-rate production upon the successful completion of operational testing.

With respect to naval vessel programs and military satellite programs, low-rate initial production is production of items at the minimum quantity and rate that preserves the mobilization production base for that system, and is feasible, as determined pursuant to regulations prescribed by the Secretary of Defense." (Ref. 21)

***b. Section 2366 – Major Systems and Munitions Programs:
Survivability Testing and Lethality Testing Required Before Full-Scale Production***

Section 2366 defines covered systems, major munition and missile programs. More significantly, it establishes key requirements for continuation in the acquisition process. Neither of these programs (covered systems, major munition or

missile), nor any improvements to them, can proceed beyond LRIP until they have completed realistic survivability or lethality testing. Survivability testing applies to covered systems and lethality testing applies to major munition and missile programs.

Realistic survivability testing of covered systems is intended to test the “vulnerability of the system in combat by firing munitions likely to be encountered in combat at the system configured for combat, with the primary emphasis on testing vulnerability with respect to potential user casualties and taking into equal consideration the susceptibility to attack and combat performance of the system.” (Ref. 21) Realistic lethality testing of major munition and missile programs tests the effectiveness (lethality) of the munition or missile on appropriate combat targets (Ref. 21)

After testing is completed, the Secretary of Defense is required to report the testing results report to the congressional defense committees. Each report “must describe the results of the survivability or lethality testing and give the Secretary’s overall assessment of the testing.” (Ref. 21)

c. Section 2399 – Operational Test and Evaluation of Defense Acquisition Programs

Completion of OT&E is another requirement for an MDAP to be able to proceed beyond LRIP. This is the bailiwick of the DOT&E, as mentioned above. The DOT&E is required to “approve (in writing) the adequacy of the plans (including the projected level of funding) for operational test and evaluation to be conducted in connection with that program.” (Ref. 21)

After OT&E, the DOT&E is required to analyze and report the results to the congressional defense committees via the USD (AT&L). In this report the DOT&E must comment on the adequacy of the OT&E and whether the programs tested “are

effective and suitable for combat.” (Ref. 21) An MDAP cannot proceed beyond LRIP without the submission and receipt of this report.

For MDAPs, the DOT&E determines the number of units procured for testing purposes. If it is not an MDAP, the military service conducting the testing determines this quantity. (Ref. 21)

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III. LOW-RATE INITIAL PRODUCTION IN THE ACQUISITION PROCESS

A. INTRODUCTION

This chapter discusses the acquisition life cycle and how LRIP is used in this process. As part of the procurement process, the acquisition phases, milestones, and categories will be explained. Additionally, this chapter will review other acquisition strategies. The discussion in this chapter reflects the most current status of the acquisition process, primarily incorporated in DoD Instruction 5000.2

B. THE MILESTONES AND PHASES

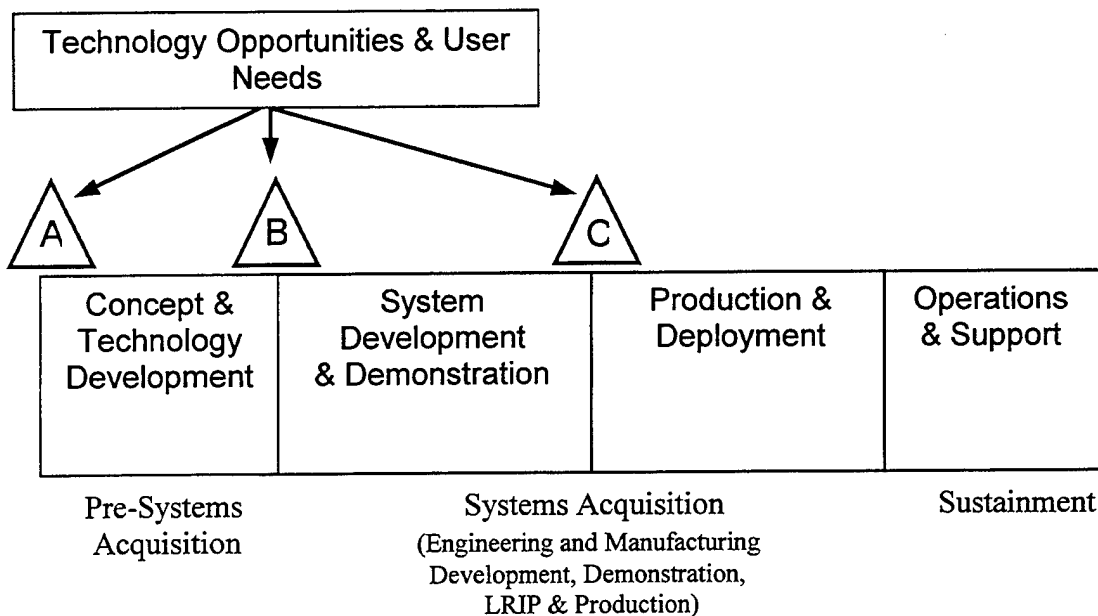


Figure 1. The 5000 Model
(After: DoDI 5000.2)

The new 5000 Model (Figure 1) has three key focuses: "1) deliver advanced technology to warfighters faster; 2) reduce total ownership costs and 3) create a more flexible process focused on interoperability, supportability, and affordability." (Ref. 22) Some of the ways it plans to accomplish this is by multiple process paths. There is no longer just one way of entering systems acquisition. The milestones are no longer a step-

by-step procedure that must start at the first milestone. Based on meeting the milestone entrance criteria, a program can skip Milestone A and proceed directly to Milestone B. Or instead of starting at Concept Exploration, it may move directly to Component Advanced Development. Another change is the emphasis on the use of market research and commercial products to increase competition. Also, there is the requirement for complete full systems demonstration before committing to low-rate production. (Ref. 22)

As part of the acquisition cycle, each phase has certain exit criteria, or conditions, that must be met before the program can advance to the next phase. These criteria are set by the Program Manager (PM) and approved by the Milestone Decision Authority (MDA). The following paragraphs highlight some of the key features of the new acquisition model which includes the decision point for determining the quantity of items to be purchased for LRIP and the LRIP phase itself.

1. **Technology Opportunities and User Needs**

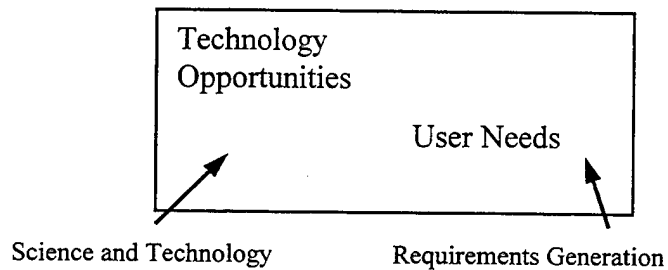


Figure 2. Technology Opportunities and User Needs Work Content
(After: DoDI 5000.2)

A statement defining the user's need is critical to every program. A new program, or an improvement to an old one, cannot go forward until such needs are spelled out. What does the user, or DoD component, want and why? This requirement and its justification are communicated through a Mission Needs Statement (MNS). The MNS,

stated in broad operational terms, "identifies and describes this need in the context of the threat it will counter." (Ref. 19. pg. 11)

The other part of this phase is considering the use of science and technology (S&T) to satisfy the need. To help keep costs down and reduce development time, the user must consider pre-existing S&T. This pre-existing S&T can reside in either the government or private sector. If the S&T does not exist, then it will have to be developed. The preference for the development of S&T is the use of commercial technologies by means of dual-use technology. However, there are maturity and integration risks that must be considered. These risks can be reduced through Advanced Technology Demonstrations (ATDs), Advanced Concept Technology Demonstrations (ACTDs) and experiments. (Ref. 19) If the technology proves to be advanced enough, it can possibly advance directly to Milestone C and LRIP.

2. Concept and Technology Development

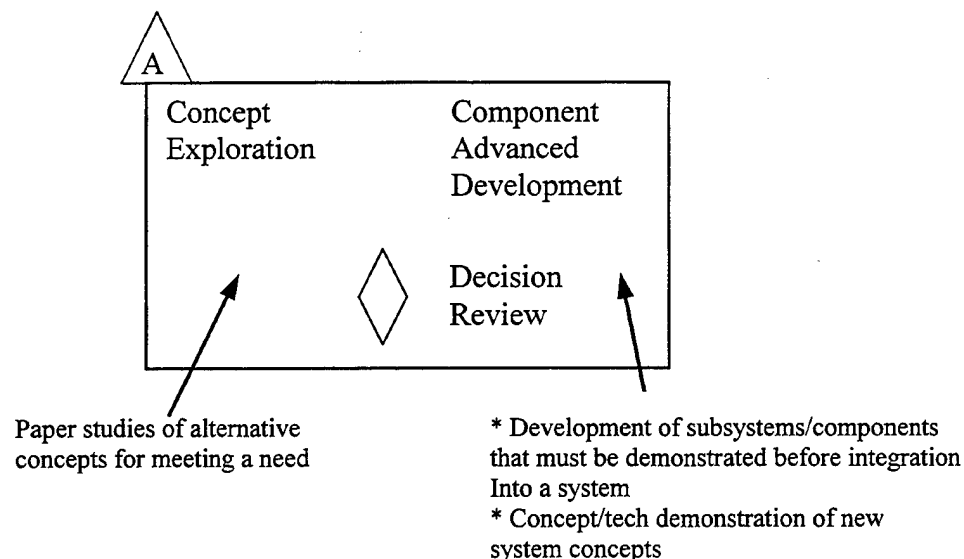


Figure 3. Concept and Technology Development Work Content
(After: DoDI 5000.2)

To enter into the Concept and Technology Development phase, a validated and approved MNS is required. The MDA reviews the MNS, considers possible technology issues and identifies any possible alternatives before making a Milestone A decision. As part of that decision, the MDA approves the start of the concept studies, appoints a lead service and approves the exit criteria. However, "a favorable Milestone A decision does not mean that a new acquisition program has been initiated." (Ref. 19, pg. 17)

During Concept Exploration, alternative concepts and their advantages and disadvantages are considered. The most promising ones are defined in several different terms, but most significantly in terms of overall acquisition and test and evaluation strategy. The second strategy includes Developmental Test and Evaluation (DT&E), Operational Test and Evaluation (OT&E) and Live Fire Test and Evaluation (LFT&E). Since the latter two decision points use units produced in LRIP, the quantity needed from LRIP for these purposes is discussed during the aforementioned strategy development.

The Decision Review in this phase is to verify the maturity of the program technology. If it is mature enough, the process can advance to the next appropriate milestone. (Ref. 19) If it is determined that the system architecture needs to be developed, the program moves into Component Advanced Development where this is accomplished.

The MNS directs the work during this process. It is also during this phase that the operational requirements document (ORD) is developed to support the start of the program. Where the MNS is expressed in broad operational terms, the ORD focuses on more specific performance parameters such as required system capabilities and characteristics as well as detailed measures of effectiveness. (Ref. 19)

3. System Development and Demonstration

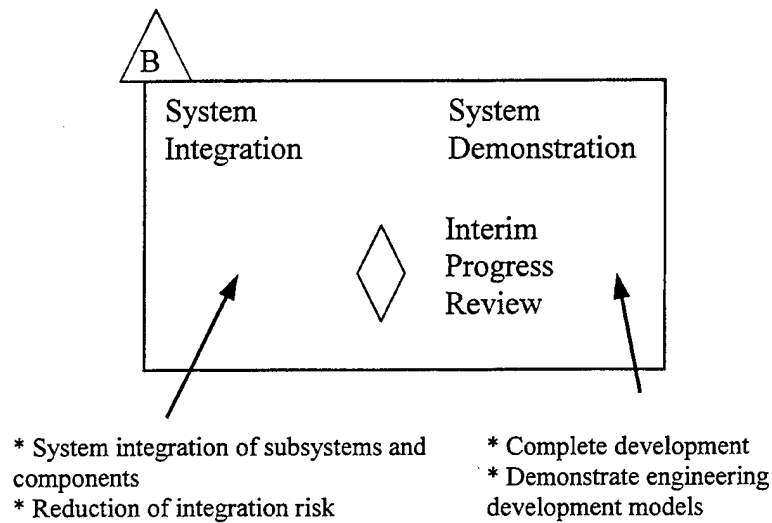


Figure 4. System Development and Demonstration Work Content
(After: DoDI 5000.2)

Entrance into Milestone B, System Development and Demonstration, requires that programs must have complete systems architecture, mature technology, an approved ORD, and that affordability has been determined. It is normally at Milestone B that the acquisition program is initiated. (Ref. 19) It is also the point where the MDA authorizes entry into System Development and Demonstration and approves the low-rate initial production quantities.

With a complete system architecture, the subsystems are integrated during System Integration and demonstrated using prototypes in a relevant environment. (Ref. 19) The purpose of the Interim Progress Review is to confirm that the program is progressing as planned or to adjust the plan based on the progress made to date, and/or if the circumstances have changed. System Demonstration is to ensure that the system supports the intentions of the validated ORD. This phase ends when a system is demonstrated in its intended environment.

4. Production and Deployment

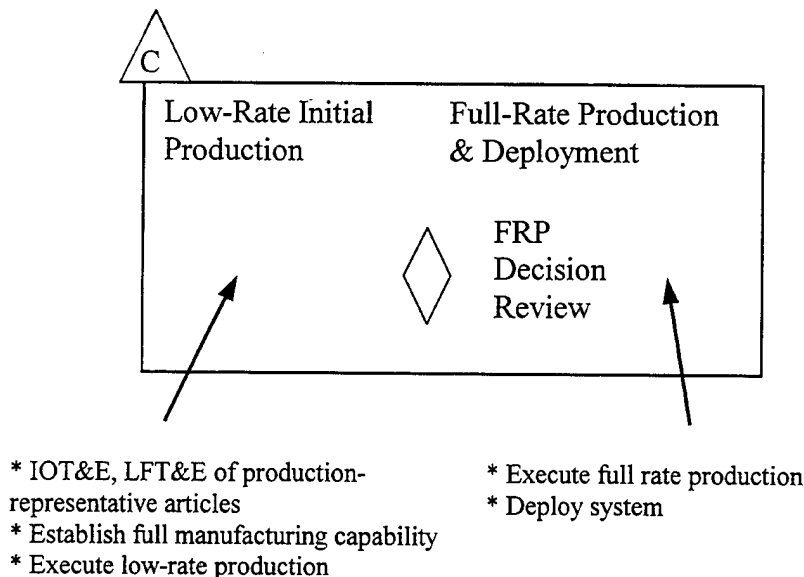


Figure 5. Production and Deployment Work Content
(After: DoDI 5000.2)

Unlike Milestones A and B, Milestone C cannot be bypassed. Every program, except Acquisition Category (ACAT) 1A programs and certain ACAT III programs, must execute low-rate production before approval of full-rate production. However, all systems must be demonstrated before DoD will commit to production (or procurement) and deployment. (Ref. 19)

Approval at Milestone C depends on meeting several requirements. Some of the criteria include technology, system architecture and software maturity and capability. Additionally, through the use of prototypes, the system integration or commercial products have been demonstrated in a relevant environment without significant manufacturing risks. An approved ORD is also required, and the interoperability and operational supportability must be acceptable. (Ref. 19)

At Milestone C the PM is authorized by the MDA to begin LRIP for MDAPs and major systems, production or procurement for non-major systems that do not require low-

rate production, or limited deployment for MAISs to prove maturity. Additionally, it is at this time that the MDA confirms the exit criteria for LRIP or limited deployment for MAISs. (Ref. 19) The PM cannot begin full-rate production without approval from the MDA.

LRIP "is intended to result in completion of manufacturing development to ensure adequate and efficient manufacturing capability and to produce the minimum quantity necessary to provide production configured or representative articles for IOT&E, establish an initial production base for the system; and permit an orderly increase in the production rate for the system, sufficient to lead to full-rate production upon successful completion operational (and live-fire, where applicable) testing." (Ref. 19, pgs. 31 – 32)

Problems encountered during developmental testing in the last phase must be resolved before proceeding beyond LRIP. The fixes are verified during IOT&E.

LRIP can be funded by either RDT&E or procurement dollars, depending on the end state of the LRIP items. If the item will only serve as a test or training item, a "hangar queen," then RDT&E funds are used. If the item will eventually be operationally fielded, then procurement funds are used.

LRIP quantities must be kept to a minimum and comply with Section 2400 of U.S.C. Title 10. The MDA must approve any LRIP quantity increases after the initial determination. If "approved LRIP quantities are expected to be exceeded because the program has not yet demonstrated readiness to proceed to full-rate production, the MDA will assess the cost and benefits of a break in production versus continuing annual buys." (Ref. 19, pg. 32)

Before moving into full-rate production and deployment, the MDA must consider whether or not the “system is operationally effective, suitable and ready for full-rate production.” (Ref. 22) As part of the consideration, the MDA must review the results of the OT&E and LFT&E.

After IOT&E, the submission of the Beyond LRIP and LFT&E Reports (where applicable) to Congress, the SecDef, and the USD (AT&L), and the completion of a Full-Rate Production Decision Review by the MDA, the program enters Full-Rate Production (or procurement) and Deployment. (Ref. 19)

5. Operations and Support

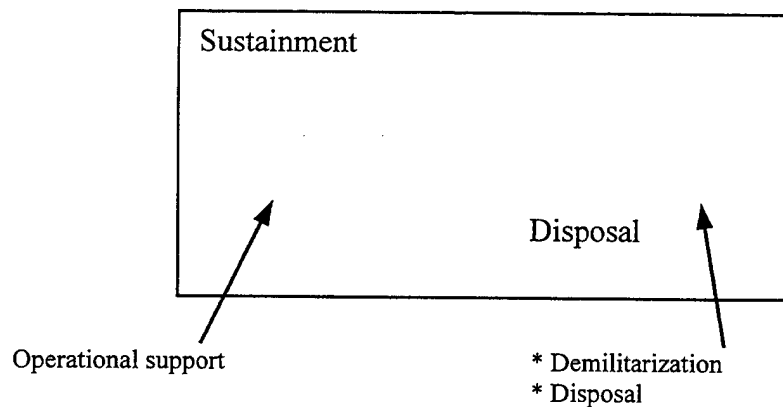


Figure 6. Operations and Support Work Content
(After: DoDI 5000.2)

Operations and Support, the final phase in the acquisition cycle, focuses on program support that not only meets operational support performance requirements, but also ensures the sustainment of systems in the most cost-effective manner. After the system reaches the end of its useful life, it must be appropriately disposed of. (Ref. 19)

C. ACQUISITION CATEGORY (ACAT)

The DoDI 5000.2 “requires that a technology project or acquisition program must be categorized based on its location in the acquisition process, dollar value, and

complexity.” (Ref. 19, pgs. 36 – 37) The level, or type, of ACAT determines whether or not a program is considered for LRIP.

There is a stronger emphasis on S&T to prove the validity of new concepts. Some examples of S&T programs are ATDs, Joint Warfighting Experiments, ACTDs, and Concept Exploration. These examples, classified as Pre-ACAT Technology Projects, happen before a program actually begins or an ACAT designation is assigned. The USD (AT&L) becomes the MDA for projects that result in a MDAP and the ASD (C3I) becomes the MDA for projects that result in a MAIS (Ref. 19)

ACAT I programs are MDAPs or are designated ACAT I by the MDA due to special interests. LRIP is a requirement for any system in this category. DoD Instruction 5000.2 defines MDAP similar to Section 2430 of U.S.C. Title 10, with the following significant differences. The USD (AT&L) designates a program as an MDAP vice the SecDef. The USD (AT&L) estimates the expenditures for research, development, test and evaluation, (RDT&E) and procurement vice the SecDef. The ceiling for RDT&E dollars is raised from \$300 million to \$365 million and procurement is raised from \$1.8 billion to \$2.19 billion. Additionally, these dollars are measured in fiscal year (FY) 2000 constant dollars vice FY 1990 dollars. (Ref. 19)

The differences in dollar amounts and base years are explained by Section 2430 of Title 10. This section gives the SecDef the authority to adjust these two figures based on DoD escalation rates. Additionally, Title 10 and other statutes do not restrict the SecDef from delegating this responsibility to the USD (AT&L)

ACAT IA programs are MAISs or are designated as ACAT IA by the MDA due to special interests. (Ref. 19) Instead of LRIP, programs in this category are deployed on a limited basis to verify maturity of the system.

ACAT II programs do not meet the cost criteria for an ACAT I program, but are major systems or are designated by the MDA due to special interests. LRIP is a requirement for all ACAT II programs. The MDA is the service secretary and is classified as the Component Acquisition Executive (CAE). No AIS programs are classified as ACAT II due to the dollar amounts associated with MAISs. (Ref. 19)

ACAT III programs do not meet the cost criteria for ACATs I, IA or II. The MDA is designated by the CAE and is at the lowest appropriate level. Less-than-major AISs are included in this category. (Ref. 19) ACAT III programs are not normally considered for LRIP, but can be for the purpose of mitigating the risk of the production process.

D. ACQUISITION STRATEGIES

The PM is responsible for the development of the acquisition strategy. This strategy is intended to map out the acquisition program from its inception to the last phase of post-production support. "The primary goal in developing an acquisition strategy is to minimize the time and cost of satisfying and identified, validated need, consistent with common sense and sound business practices." (Ref. 20, pg. 20) Two considerations in this strategy include the use of prototypes and concurrency. These two issues are relevant in the discussion of LRIP in that units produced in LRIP may be considered prototypes and that the use of concurrency negates the need for LRIP. Neither of these is true.

1. Prototypes

A prototype is a "*representative* of a concept, subsystem, or production article with potential utility". (Ref. 23, pg. VI) The use of prototypes in the modern military is not a new concept. However, their use, or lack thereof, has varied since World War II. "Prototyping, particularly for aircraft development, was fairly common into the 1950s. With the use of 'total system concept' in the early 1950s, the use of prototyping in the U.S. weapon system development declined." (Ref 23, pg. 1) Another key reason for the decline of prototyping at this time was the increased complexity of the weapons systems being produced.

Prototyping was replaced by paper proposals and competitions, based on paper analyses of how the weapon system should perform. By the mid-sixties, this resulted in extensive volumes of paper, huge design teams, and billions of dollars invested before production even began. A project was rarely cancelled, once proven on paper that it should work, even if it was a non-performer. This method, known under Secretary of Defense Robert McNamara as "Total Package Procurement," came under attack from Congress by the early seventies. (Ref. 24)

Assistant Secretary of Defense David Packard reversed this course with the "fly-before-you-buy" principle in 1970. Packard urged defense officials "to make sure the item works right before committing to go into full-scale production. Often it meant building and testing a prototype." (Ref. 30 Arming the Eagle, pg. 413)

Packard was supported in his efforts by the Blue Ribbon Defense Panel of 1970 when it recommended, "More use of competitive prototypes and less reliance on paper studies." (Ref. 25, pg. 74) Additionally, OMB Circular A-109 called for, when appropriate, competitive demonstrations that would involve the use of prototypes.

In 1986 Packard was asked to lead the President's Blue Ribbon Commission on Defense Management. He reiterated the significance of prototyping, recommending that "a high priority should be given to building and testing prototype systems and subsystems before proceeding with full-scale development." (Ref. 6, pg. XXV) Although prototypes were being used at this time, it was the opinion of the Commission that they were not being used enough. Many believed the use of prototypes slowed down the acquisition process and increased the costs early on. The Commission countered that, although it may increase the costs early on, the use of prototypes reduced the risks of the program production and reduced total costs in the long run.

Finally, in 1987, under the encouragement of Congress, prototyping "formally became part of Department of Defense acquisition regulations." (Ref. 23, pg. 1) It is a requirement in the new regulations also. The DODI 5000.2 states that a "program shall exit System Integration when the integration of the system has been demonstrated in a relevant environment using prototypes." (Ref. 19, pg. 28) Further on it states that a "program shall enter System Demonstration when the PM has demonstrated the system in prototype articles. This effort is intended to demonstrate the ability of the system to operate in a useful way consistent with the validated ORD." The DoD 5000.2-R (Interim) reemphasizes this point by directing that "early testing of prototypes in System Development and Demonstration, and early operational assessments shall be emphasized to assist in identifying risks." (Ref. 20, pg. 19, Part 3)

The difference between a prototype and a LRIP unit, besides where they fall in the phases and milestones, is that a prototype is only a representative of the end product. Its purpose is to test and confirm new technologies, designs, etc. As deficiencies are

discovered, or concepts and systems proved, the prototype evolves. An LRIP unit is the end state of the prototype testing. The problems or discoveries have all been corrected or applied to produce an actual production line item.

2. Concurrency

Concurrency is a dynamic process. It is development and production at the same time. However, before a system can enter into LRIP, it must be stable. The assumption behind LRIP is that the development stage is over.

The concept of concurrency evolved in the late 1950's. A concurrent program is when production starts while development is still going on. A non-concurrent program is when production starts after development is complete. The threat posed by the Soviet Union meant that weapons systems needed to be provided quickly to counter that threat. Concurrency supported this procurement necessity. Not only was this concept more expedient in production, thus reducing the time in the acquisition process, it was also believed to provide a cost savings.

"The date for a new system to become operational would be influenced by the desire to field it as soon as possible and the assumption that everything would proceed according to plan. This often would necessitate starting production before the development and testing were completed (concurrency) and building up large organizations very quickly to handle all phases of a compressed development and production program with little room for learning or mistakes." (Ref. 4, pg. 74) Since everything did not go according to plan, and the lack of room for learning, i.e., "the system did not measure up to initial expectations and costs grew unexpectedly" (Ref. 4, pg. 74), the Commission recommended that the use of concurrency in production be reduced.

GAO believed that concurrency was an effective technique, if managed correctly. However, they did express concern that concurrency could increase the risk of major production flaws. (Ref. 9) The risk increased if the production included new and/or complex systems. Later, GAO changed its position on concurrency. This change of opinion was brought about by the fall of the Soviet Union. "The change in threat to national security reduces the justification for concurrent development and production of major weapon systems and supports the Packard Commission's acquisition strategy that favors the increased use of prototypes." (Ref 26, pg. 3)

Concurrency is still an option to be considered by PMs when developing an acquisition strategy. The necessity for a weapons system to counter a new and immediate threat may justify the use of concurrency. However, "the benefits and risks associated with reducing lead time with (it) must be specifically addressed." (Ref. 20, pg. 20)

E. SUMMARY

This chapter presented the new acquisition milestone and phases, the 5000 model, and the role played by LRIP within it. This new model strongly advocates S&T, but it also has increased the significance of LRIP. The ACATs were covered to provide a more thorough comprehension of acquisition issues and how they are classified. Finally, two acquisition strategies were covered to clarify their relationship to LRIP in the acquisition process. This material is required to better understand the proceeding analysis of LRIP.

IV. ANALYSIS AND CONCLUSION

A. INTRODUCTION

This chapter analyzes LRIP problems that have been encountered in the acquisition process. GAO and the DODIG have been investigating and reporting acquisition problems for many years. The commissions and panels covered in chapter two discussed these issues also, but mostly in general terms. The GAO and DODIG audit reports are more detailed and cover specific weapon systems. This chapter will not cover every LRIP problem addressed by these two agencies, but will instead focus on two that are relevant to this thesis. The two major areas of concern in relation to LRIP are the quantity of articles produced during LRIP and the question of when a program is ready for LRIP.

B. ANALYSIS

1. Quantity Issues

Before the *FASA* limited LRIP quantities to at least one operationally configured production unit and not more than ten percent of the total number of articles to be produced, (Ref. 13) PMs were restricted to the minimum number necessary. (Ref. 21) The latter definition proved to be ambiguous and subject to the interpretation of the Program Management Offices (PMOs). A 1993 DODIG audit discovered that in some cases the "quantities were determined primarily by contractor or initial production schedules and funding availability rather than the goal of minimizing total LRIP quantities." (Ref. 27)

A GAO audit that followed a year later addressed the same quantity concerns. It found in several cases that the percentage of units procured in LRIP was excessive. GAO

considered LRIP quantities greater than ten percent of a system's total procurement as unwarranted. It found that 33 percent of C-17 and T-45A aircraft were procured during LRIP. In the case of the F-14D, Airborne Self-Protection Jammer, MK-50 Torpedo, and the AN/ALQ-131 and AN/ALQ-135 jammer programs, 100 percent of the authorized amounts to be procured for these programs was done during LRIP. It is not surprising then, that GAO concluded that in some cases the LRIP decision was, in fact, the full-rate production decision. (Ref. 28)

GAO and the DODIG attempted to determine the reason for the disproportionate LRIP quantities. One answer was opportunistic PMOs or contractors who took advantage of the vague LRIP quantities limitation to procure beyond what would be considered "minimum" or "necessary." However, the audits concluded that the primary reason for excessive LRIP quantities was due to a limited production readiness problem.

2. Readiness Issues

Readiness for LRIP implied that the weapon system had met design, testing and preparation for production prerequisites. This meant that the design was stable, i.e., no additional changes were expected, developmental testing was completed, discovered deficiencies were fixed, and all production preparation reviews were conducted. The items produced during LRIP were to represent an actual production line unit, ready for operational deployment to the field.

However, the regulations and policy guidance addressing LRIP did not provide clear and sufficient guidance on this matter. (Ref. 27) There was not one single regulation that specifically defined the prerequisites for entrance into LRIP. Not only did the acquisition regulations fail to provide adequate procedural guidance on the LRIP

process, they also failed to mandate oversight. A program review and MDA approval for entrance into LRIP was recommended, but was not required. (Ref. 27)

Another "oversight" issue concerns program funding schedules, which often became the default LRIP entrance criterion. After an acquisition program schedule and funding were approved, PMs were very reluctant to seek changes. Schedule slips usually required reviews, and possibly congressional involvement, which could delay or even jeopardize a program. This often meant that LRIP commenced according to the acquisition strategy schedule and the arrival of production dollars, whether or not the program was "ready." If the funds were not spent when intended, they could be reprogrammed and possibly never returned, which could threaten the future of the project. (Ref. 29) If the program was not ready for full-rate production when scheduled, additional LRIPs were conducted to prevent the loss of the production dollars. (Ref. 30) This, of course, led to excessive quantities produced during LRIP. Also, the production dollars expended during the additional LRIPs came from funding intended for full-rate production. This decreased the number of units able to be produced after development stabilized and full-rate production was approved. Thus LRIP units that did not match the final production design had to undergo expensive retrofits so that they could be fielded.

"Concurrency creep" was one of the consequences of regulatory ambiguity and the "program funding schedule" entrance criterion. (Ref. 29) Concurrency creep occurred when a program entered into LRIP before the concurrency development had been stabilized, i.e., before designs and development were complete. As the engineering and manufacturing designs were stabilized, the overall number of units produced during LRIP increased.

Problems have also been encountered due to continuous design changes and additions to the system after a program enters LRIP. Two main reasons, engineering developments and parochial interests, usually explained these late changes. Engineering developments were required due to technology failure or obsolescence. Sometimes technology proven in developmental testing on prototypes was insufficient or failed during more rigorous operational testing during LRIP and had to be upgraded or replaced. Another situation could occur if the weapon system acquisition process took so long that the technology actually became obsolete and had to be changed.

An example of parochial interests causing design changes and additions after a program entered initial production is the F-16. The winning prototype, developed using the specifications disseminated to the hopeful contractors, was completely revamped after the "fly-off." The capabilities of the F-16 prototype were too similar to that of the F-15 and would threaten that system if it continued as-is. Consequently, the F-16 was practically rebuilt after it entered into full-scale engineering development and initial production. (Ref. 31)

Readiness for LRIP may, under certain circumstances, be determined by extraordinary events. If military needs are great enough, such as during a time of war, many of the coordinated processes associated with weapons acquisition are cast aside. During Desert Storm, several systems were fielded that had not completed engineering development or LRIP. Some, such as the Joint Surveillance Target Attack Radar Systems (JSTARS), were still in LRIP when they were deployed to the Persian Gulf. Other examples include the Low-Altitude Navigation and Targeting Infrared System for Night (LANTIRN), the Advanced Medium Range Air-to-Air Missile (AMRAAM), and

the Standoff Land-Attack Missile (SLAM). These and other pre-maturely fielded systems were reported to have performed well even though they had not completed proper development in testing. (Ref. 3) It could be said that there is no more ultimate test of a weapon than in real combat.

Ironically, in the case of JSTARS, a GAO report concluded that the full-rate production decision was premature. The system, according to GAO, should have continued in LRIP to ensure operational effectiveness for combat and to achieve cost reductions and efficiencies. (Ref. 32)

C. CONCLUSION

Problems that have been encountered with LRIP have been due to its implementation and not the concept itself. In fact, it has been consistently recommended that all weapon system production never proceed beyond low rate production. The *Fitzhugh Commission* first came to this conclusion in 1970. Thirty years later, RAND recommended that DoD "maintain production of key systems at a low rate and should close down production lines in ways that make restarting production feasible in terms of difficulty, time and cost." (Ref. 33, pg. 32-33)

The problem encountered with excessive quantities produced during LRIP has been addressed through legislation. Since the incorporation of the *FASA* into Section 2400, Title 10 of the U.S. Code in 1994, the issue of LRIP quantities has not been a significant problem. There has been only one GAO or DODIG audit since then that has addressed this problem.

The new regulations, DoD Directive 5000.1, DoD 5000.2-R (Interim) and particularly the DoD Instruction 5000.2, with the new 5000 model, should minimize

problems with LRIP readiness. They provide more exact guidance and have significantly reduced the ambiguity of previous versions.

DoD Instruction 5000.2 defines unprecedented and exacting entrance and exit criteria between acquisition phases. The requirements for entrance into LRIP are spelled out explicitly for the first time. Transition from LRIP to full-rate production can no longer be based upon the seemingly unquantified approval of the MDA anymore. DoD Instruction 5000.2 has officially *mandated* decision reviews, which, in previous regulations, were only *recommended*. These include a full-rate production decision review where, among other things, the results of LRIP testing must be considered before the MDA can grant approval. Additionally, all results of testing and decisions must be justified in official reports.

Once, during a congressional hearing on acquisition reform, a member stated that legislating acquisition reform was easy and common, but that enforcing it was a totally different matter. The new regulations and the new acquisition model, based upon the findings and recommendations of past GAO audits, may represent the necessary enforcement.

D. RECOMMENDATIONS FOR FURTHER RESEARCH

The impact of the new regulations and acquisition model should be researched after they have been given ample time to be fully implemented by DoD and the acquisition community. Furthermore, it would be useful to pursue the Program Manager side of the new structure. For example, a study could be made of the impact of changing the funding schedule on an acquisition program. Such a change would seem to have a negative impact in numerous ways, which challenges the integrity of the process.

LIST OF REFERENCES

1. *Glossary of Defense Acquisition Acronyms and Terms*, Ninth Edition, Defense Systems Management College Press, November 1998.
2. United States Congress, House, Defense Policy Panel and Acquisition Policy Panel of the Committee on Armed Services, *Defense Acquisition: Major U.S. Commission Reports (1949 - 1988)*, Volume I, Government Printing Office, Washington, D.C., 1988.
3. Jones, Wilbur D. Jr., *Arming the Eagle; A History of U.S. Weapons Acquisition Since 1775*, Defense Systems Management College Press, 1999.
4. Report on the Commission on Government Procurement, Volume 4, Government Printing Office, Washington, D.C., December 1972.
5. *Legislative Recommendations of the Commission on Government Procurement: 5 Years Later*, Report to the Congress of the United States by the Comptroller General, Government Printing Office, Washington, D.C., July 31, 1978.
6. President's Blue Ribbon Commission on Defense Management *A Quest for Excellence, Final Report to the President*, June 1986.
7. President's Blue Ribbon Commission on Defense Management, *Interim Report to the President*, February 28, 1986.
8. President's Blue Ribbon Commission on Defense Management, *A Formula for Action, A Report to the President on Defense Acquisition*, April 1986.
9. General Accounting Office, GAO/NSIAD-90-107, *WEAPONS TESTING, DoD Needs to Plan and Conduct More Timely Operational Tests and Evaluation*, May 1990.
10. President's Private Sector Survey On Cost Control, *Report to the President*, Volumes I and II, January 15, 1984.
11. Department of Defense Authorization Act 1990/1991 (P.L. 101-189), November 29, 1989.
12. General Accounting Office, GAO/NSIAD-95-18, *TEST AND EVALUATION; Impact of DoD's Office of the Director of Operational Test and Evaluation*, October 1997.
13. Federal Acquisition Streamlining Act of 1994 (P.L. 103-355), October 13, 1994.
14. *Introduction to Defense Acquisition Management*, Fourth Edition, Defense Systems Management College Press, June 1999.

15. Office of Management and Budget, Office of Federal Procurement Policy, *Major Systems Acquisition; A Discussion of the Application of OMB Circular No. A-109*, Government Printing Office, Washington, D.C., August 1976.
16. Acker, David, D., *Acquiring Defense Systems – A Quest for the Best*, Defense Systems Management College Press, July 1993.
17. Department of Defense Manual 4245.7-M, *Transition from Development to Production (Includes Change 1 Dated 13 Feb 89)*, September 1985.
18. Department of Defense Directive 5000.1, *The Defense Acquisition System*, 23 October 2000.
19. Department of Defense Instruction 5000.2, *Operation of the Defense Acquisition System*, 23 October 2000.
20. Interim Regulation Department of Defense 5000.2-R, *Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs*, 23 October 2000.
21. United States Code – Title 10.
22. Defense Acquisition University, New DoD Documents Brief, n.d.
23. Drezner, Jeffery A., *The Nature and Role of Prototyping in Weapon System Development*, RAND, 1992.
24. Fallows, James, *National Defense*, Random House, 1981.
25. Blue Ribbon Defense Panel, *Report to the President and the Secretary of Defense on the Department of Defense*, Appendix E, July 1970.
26. General Accounting Office, GAO/NSIAD-91-269, *ACQUISITION REFORM; Implementing Defense Management Review Initiatives*, August 1991.
27. Department of Defense Inspector General, *Low Rate Initial Production in Major Defense Acquisition Programs*, 17 June 1993.
28. General Accounting Office, GAO/NSIAD-95-18, *WEAPONS ACQUISITION; Low-Rate Initial Production Used to Buy Weapon Systems Prematurely*, November 1994.
29. Interview with Dave Matthews, Senior Lecturer, Department of Systems Management, Naval Postgraduate School, and the author, 14 November 2000.
30. E-mail from Dave Matthews, Senior Lecturer, Department of Systems Management, Naval Postgraduate School, to the author, Subject: LRIP QUESTION, October 05, 2000.

31. United States Congress, House, Committee on the Budget, *Review of Acquisition and Management*, Government Printing Office, Washington, D.C., 1984.
32. General Accounting Office, GAO/NSIAD-97-68, *TACTICAL INTELLIGENCE; Joint STARS Full-Rate Production Decision Was Premature and Risky*, April 1997.
33. Carlucci, Frank, Hunter, Robert, and Khalilzad, Zalmay, *Taking Charge: A Bipartisan Report to the President Elect on Foreign Policy and National Security*, RAND, 13 November, 2000.

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BIBLIOGRAPHY

ACQ 201 Intermediate Systems Acquisition Course, *Systems Engineering Study Guide*, Defense Systems Management College Press, September 1997.

Beck, C.L. Jr., Brokaw, N.L., and Kelman, B.A., *A Model for Leading Change; Making Acquisition Reform Work*, Defense Systems Management College Press, December 1997.

DSMC Program Managers Tool Kit, Ninth Edition, Defense Systems Management College Press, March 1999.

Department of Defense, *Annual Report – Fiscal Year 1980*, Government Printing Office, January 25, 1979.

Department of Defense Inspector General, *The Low-Rate Initial Production Decision for the Joint Biological Point Decision System*, September 11, 2000.

Department of Defense Inspector General, *V-22 Osprey Joint Advanced Vertical Aircraft*, August 15, 2000.

Drezner, J. A. and Smith G.K., *An Analysis of Weapons Systems Acquisition Schedules*, RAND, 1990.

Gates, William, *Department of Defense Procurement Policy Reform; An Evolutionary Perspective*, Naval Postgraduate School, Monterey, California, January 1989.

General Accounting Office, GAO/NSIAD-96-193BR, *1997 DEFENSE BUDGET; Potential Reductions and Rescissions to DoD's Procurement and RDT&E Programs*, September 1996.

General Accounting Office, GAO/NSIAD-91-11, *ACQUISITION REFORM; Defense Management Report Savings Initiatives*, December 1990.

General Accounting Office, GAO/NSIAD-96-162, *BEST PRACTICES; Commercial Quality Assurance Practices Offer Improvement for DoD*, August 1996.

General Accounting Office, GAO/NSIAD-99-4, *DEFENSE ACQUISITION; Advanced Concept Technology Demonstration Program Can Be Improved*, October 1998.

General Accounting Office, GAO/NSIAD-93-15, *WEAPONS ACQUISITION; A Rare Opportunity for Lasting Change*, December 1992

General Accounting Office, GAO/NSIAD-97-23, *WEAPONS ACQUISITION; Better Use of Limited DoD Acquisition Funding Would Reduce Costs*, February 1997.

Jones, Wilbur D. Jr., *Congressional Involvement and Relations*, Fourth Edition, Defense Systems Management College Press, April 1996.

Jones, Wilbur D. Jr., *From Packard to Perry; A Quarter Century of Service to the Defense Acquisition Community*, Defense Systems Management College Press, June 1996.

Kausal, Tony, et al, *A Comparison of the Defense Acquisition Systems of France, Great Britain, Germany and the United States*, Defense Systems Management College Press, September 1999.

Lewis, S.M., *Assessing the Impact of Low Rate Initial Production on Army Missile System Procurement*, Master's Thesis, Naval Postgraduate School, Monterey, California, March 1994.

Medler, L.P., *Low Rate Initial Production in Army Aviation Systems Development*, Master's Thesis, Naval Postgraduate School, Monterey, California, March 1994.

Packard, David, *Management of America's National Defense*, American Enterprise Institute, 1987.

Paysan, Mike. (2000). Generate Mission Need Statement (MNS). *Defense Acquisition Deskbook*, Office of the Secretary of Defense. Available:
<http://web2.deskbook.osd.mil/irp/1122.asp> [13 November 2000]

Program Manager's Tool Kit, Seventh Edition, Defense Systems Management College Press, March 1998.

Recommendations of the Commission on Government Procurement: A Final Assessment, Report to the Congress of the United States by the Comptroller General, Government Printing Office, Washington, D.C., May 31, 1979.

Reig, R.W., et al, *A Study of the Relationships between Initial Production Test Articles Used in a System Development Program and the Success of That Program*, Defense Systems Management College Press, May 1995.

Svetlich, William G., *National Security Management; The Systems Acquisition Process and Its Limitations in the Department of Defense*, National Defense University, 1979.

Undersecretary of Defense Memorandum, Subject: Quantities to be Procured for Low-Rate Initial Production, APR 14, 1995.

United States Congress, House, Acquisition and Procurement Policy Panel of the Committee on Armed Services, *Acquisition Reform – 1986*, Government Printing Office, Washington, D.C., 1987.

United States Congress, House, Committee on Armed Services, *Recommendations of the Grace Commission*, Government Printing Office, Washington, D.C., 1987.

United States Congress, House, Committee on Government Operations, *Commission on Government Procurement*, August 12, 1969.

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GLOSSARY

Advanced Concept Technology Demonstration

Advanced Concept Technology Demonstrations are used to determine the military utility of proven technology and to develop the concept of operations that will optimize effectiveness. (Ref. 19) ACTDs are DoD efforts to address a general need or deficiency within the department that may benefit more than one service.

Advanced Technology Demonstration

Advanced Technology Demonstrations are used to demonstrate the maturity and potential of advanced technologies for enhanced military operational capability or cost effectiveness. (Ref. 19) ATDs are sponsored by an individual service to address a specific need.

Covered system

A covered system is any vehicle, weapon platform, or conventional weapon system that includes features designed to provide some degree of protection to users in combat and is a major system. (Ref. 21)

Exit criteria

Exit criteria are some level of demonstrated performance outcome (e.g., level of engine thrust), the accomplishment of some process at some level of efficiency (e.g., manufacturing yield) or successful accomplishment of some event (e.g., first flight), or some other criterion that indicates that aspect of the program is progressing satisfactorily (Ref. 20, pg. 18).

Major Automated Information System

A Major Automated Information System is designated by ASD (C3I), or estimated to require program costs in any single year in excess of \$32 million in FY 2000 constant dollars, total program costs in excess of \$126 million in FY 2000 constant dollars, or total life-cycle costs in excess of \$378 million in FY 2000 constant dollars. MAISs do not include highly sensitive classified programs (as determined by the SecDef) or tactical communication systems. (Ref. 20, pg. 2)

Major Defense Acquisition Program

An acquisition program that is estimated by the Secretary of Defense to require an eventual total expenditure for research, development, test, and evaluation of more than \$300,000,000 (based on fiscal year 1990 constant dollars) or an eventual

total expenditure for procurement of more than \$1,800,000,000 (based on fiscal year 1990 constant dollars)." (Ref. 51, Title 10) The SecDef also has the authority to designate any program as an MDAP, if deemed necessary. If the SecDef classifies a program as highly sensitive, it cannot be an MDAP. (Ref. 21)

Major System

A major system is a combination of elements that function together to produce the capabilities required to fulfill a mission need, including hardware, equipment, software, or any combination thereof, but excluding construction or other improvements to real property. Additionally, it will be considered a major system if it is estimated to require an eventual total expenditure for RDT&E of more than \$140 million in FY 2000 constant dollars, or for procurement of more than \$660 million in FY 2000 constant dollars, or if designated as major by the DoD Component Head. (Ref. 20, pg. 3)

Milestone Decision Authority

A Milestone Decision Authority is the individual designated in accordance with criteria established by the USD (AT&L), or by the ASD (C3I) for AIS acquisition programs, to approve entry of an acquisition program into the next phase of the acquisition process." (Ref. 20)

Operational Test and Evaluation

The field test, under realistic combat conditions, of any item of (or key component of) weapons, equipment, or munitions for the purpose of determining the effectiveness and suitability of the weapons, equipment, or munitions for use in combat by typical military users and the evaluation of the results of such test. (Ref. 21)

Program Manager

The individual designated in accordance with criteria established by the appropriate Component Acquisition Executive to manage an acquisition program, and appropriately certified under the provisions of the Defense Acquisition Workforce Improvement Act (10 U.S.C.1701 et. seq.). A PM has no other command or staff responsibilities within the Component. (Ref. 18)

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429 Prairieview Drive
West Des Moines, Iowa 50265